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EDITORIAL -- OUR RESPONSIBILITY

by Tom Mitchell, WA3TBD

At their January meeting, the ARRL Board of Directors selected the League's "President's Goals for 1973." Following the general principles of promoting amateur radio nationally and internationally came fostering the growth of the amateur satellite program.

Coming from the Board of the nation's representative amateur organization, this goal carries the concern of all amateurs. The reason is responsibility.

Those of us who are involved in amateur satellites carry even more responsibility than that of every amateur: to contribute to advancing the state of the radio art. This quest is morally imposed on all hams; imposed in a special way on satellite experimenters.

This program is the state of the amateur art; it is in bold contrast to "appliance operators" who derive only enjoyment and contribute nothing to their hobby. This program is in the best traditions of amateur radio.

Those who use the OSCAR satellites have a responsibility to level-headedly obey the rules, particularly the power limitation rule. (FCC has already made a specific statement on this matter.)

Activities like OSCAR DXCC have their place, especially to promote the use of OSCARS, but it will be scientific experimentation and public service which will be the deciding factor for the future of our avocation. Just as the very use of any frequency at all for amateurs must be rigorously justified by public interest, convenience or necessity, so will frequencies for the Amateur Satellite Service.

AMSAT Nets

All interested amateurs are invited to check into one or more of the following AMSAT nets:

Sundays	1800Z	14280 KHz
Sundays	1900Z	21280 KHz
Mondays	7:00 P.M. EST (0000Z Tuesday)	3855 KHz

Note that beginning April 30, the 3855 KHz net will be held at 9:00 P.M. EDT (0100Z).

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By Perry Klein, K3JTE

The AMSAT Experimenters Meetings

During late January AMSAT hosted international experimenters meetings to finalize the design of AMSAT-OSCAR-B (A-O-B)*, AMSAT's follow-on satellite to OSCAR 6. Brought over especially for these meetings were Dr. Peter Hammer, VK3ZPI of the WIA-Project Australis group from Melbourne, Australia, and Karl Meinzer, DJ4ZC of the EURO-OSCAR group from Marbach, W. Germany. Also attending were John Goode, W5CAY from Texas (developer of the Morse code telemetry encoder and Codestore units now aboard OSCAR 6), Lance Ginner, K6GSJ of Project OSCAR from California (one of the constructors of the early OSCAR satellites), and Dick Kolbly, K6HJJ of the California Jet Propulsion Lab. Radio Club, an AMSAT Member Society. During a period of three weeks an intensive series of meetings, design reviews and equipment lab tests took place. Many of the details pertaining to the configuration of A-O-B were established.

Karl Meinzer brought with him the flight unit of the 70 cm input, two meter output EURO-OSCAR translator which he and DJ5KQ have constructed. The March 1971 "AMSAT Newsletter" carries a technical description of this unit. The operation of this unit was demonstrated in the laboratory. Peter Hammer brought over one of the new Mark II Australis command decoders for A-O-B, and also the flight unit of the WIA-Project Australis teletype telemetry encoder, which was demonstrated to us in transmissions over the AMSAT 146.85 MHz Washington area FM link. This latter unit was returned to Australia for final completion and environmental tests.

The results of the experimenters meetings are significant because they firm up the design of AMSAT's next satellite (A-O-B) and make plans for an additional spacecraft to follow it into orbit. As decided at the meetings and subsequently approved by the AMSAT Board of Directors, the following experiments are now planned for A-O-B:

--The DJ4ZC/DJ5KQ EURO-OSCAR translator. This is a 10-14 watt PEP linear translator which accepts uplink signals between 432.125 and 432.175 MHz, and retransmits them between 145.975 and 145.925 MHz. The passband is inverted, i.e., an upper sideband uplink signal is transmitted as a lower sideband signal on the downlink and vice versa. The translator has a low power mode (approximately 2.5 watts PEP) for operation when battery power is low.

--A five-watt version of the two-to-ten meter linear translator now flying in OSCAR 6. The uplink frequency range will be 145.9 to 146.0 MHz as in the present satellite, but the downlink frequency range may be changed from that used in OSCAR 6 (see "Frequency Selection for AMSAT-OSCAR-B" elsewhere in this issue).

--A one-watt two-to-ten meter linear translator identical to the OSCAR 6 translator but with the same frequency plan as the five-watt version. This translator will only serve as a backup to the five-watt unit and will be used only if the higher power unit fails or during periods when battery charge is low.

--A 435.1 MHz telemetry beacon.

--Two redundant Australis Mark II 35 channel command decoders.

--The WIA-Project Australis RTTY telemetry encoder. This unit has a 60-channel capability plus an additional dozen channels of binary logic status indicators. Standard 850 Hz AFSK teletype is used at 60 wpm (45.5 baud), with phase coherent 2125 and 2975 Hz audio tones to permit the use of phase lock loops for reception.

--A 24-channel Morse code telemetry encoder identical to the one now in OSCAR 6.

--A Codestore message storage unit similar to the one in OSCAR 6.

*A-O-B will be given an OSCAR number designation once successfully in orbit.

--An experiment control logic system.

The experiment control logic will switch A-O-B between four basic modes:

Mode A - five-watt 2/10 translator
or one-watt 2/10 translator
(the selection between units is made by ground command).

Mode B - 432/146 MHz translator in 10-14 watt mode.

Mode C - 432/146 MHz translator in 2.5 watt mode.

Mode D - Recharge mode.

The 435.1 MHz telemetry beacon may be operated in Modes A or D, but only when switched on by ground command. A 24-hour clock in the experiment control logic will switch between Mode A and Mode B each 24 hours. An automatic battery undervoltage sensor switches A-O-B into Mode C if the battery charge drops to some predetermined cutoff level, and Mode D is activated by this same sensor if a further battery discharge condition is reached. It is expected that the A-O-B power system will be capable of 3 to 4 times the power available in OSCAR 6 and that we can keep the spacecraft in operation 100% of the time, hopefully throughout its three year design lifetime.

Another significant result of the experimenters meetings was the agreement that the WIA-Project Australis group would undertake the development of a new satellite, A-O-D, built around the Australis four-channel 146-to-435 MHz FM repeater and RTTY telemetry encoder. AMSAT will provide solar panels, batteries, the structure, and possibly two-to-ten meter repeater, Morse code telemetry and Codestore units for integration in Australia. As a result, two satellites were decided upon (A-O-B and A-O-D) to be built for the worldwide amateur community.

OSCAR 6 Quirks

On January 9 a problem developed in OSCAR 6's 435.1 MHz beacon transmitter and its power output dropped considerably. Now, only the best equipped 70-cm stations having antennas with 20 dB or more of gain can hear the beacon. The cause of this problem is yet undetermined. It is thought that possibly the driver or final amplifier transistor has failed, or else that high temperatures in the spacecraft have caused the beacon's gain to drop off sharply.

The temperature of OSCAR 6, especially the battery temperature (channel 3D) continues to run increasingly high. It has now reached as high as 47°C. (117°F.) and is a cause for concern. This may be a limiting factor on OSCAR's useful lifetime, since battery life is shortened drastically at elevated temperatures. We have not yet found a satisfactory explanation of what is happening since OSCAR was designed to stabilize at 15-20°C. (60-70°F.). Fortunately, however, there is not yet any sign of degradation in the spacecraft's power system.

The 29.45 MHz beacon transmissions now appear to be quite readable on many passes, especially when the repeater AGC is kept on by the ground control stations. Since this beacon is now the only source of OSCAR 6 telemetry data, the two-to-ten meter translator (which contains the beacon transmitter) is turned on daily for brief periods to obtain telemetry information. It is very important that all stations refrain from transmitting through the satellite on the scheduled OFF days (currently Tuesdays through Wednesdays GMT) to permit telemetry data to be taken and the battery to recharge. It is difficult to copy the beacon if the translator is loaded with signals in the passband, since the same power amplifier stage in the translator must share the limited power between the beacon and communication signals. It is also important that all users on the scheduled ON days keep clear of 145.900-145.910 MHz, as transmissions at these frequencies can result in interference at the 29.45 MHz beacon frequency.

Internally generated, random switching of OSCAR's experiment control logic circuits, evidently caused by electrical transients, continues to be a problem, but has now been largely overcome through the intensive use of ground command to reset the spacecraft's logic into its correct states on each orbit. To this end, the primary control station in Canada has succeeded in automating his station to automatically send a programmed list of commands to the spacecraft every 2-1/2 minutes during each pass, the instructions coming from punched teletype tape.

Some amateurs observing the telemetry have noticed that according to telemetry channel 2A, the -Y solar panel does not seem to be working and is possibly intermittent. It is suspected that this panel may be introducing the transients into the power system, particularly as OSCAR enters sunlight at about 40°N. and 20°S. latitude during each orbit. The theory is that thermal stress on the panel may be causing intermittent spikes to be produced in the power system.

The Codestore system appears to be working properly, but has not gotten a large amount of use due to the existence of only one ground loading station. Additional ground loading units are being constructed and should be in operation soon. Keep listening to Codestore transmissions on the 29.45 MHz beacon for operational data on when OSCAR's translator is scheduled to be in operation.

F9FT REPORT: December 12, 1972

Remarks about the 70 cm beacon:

Its signal is very strong here, quite often, and even most of the time 35 to 40 dB above noise. But there is from time to time quite a slow and very deep QSB, which makes the signal disappear for a couple of minutes.

According to the telemetry system, the panel -Y does not seem to work; it is always sent "296," which means that there is practically no load current. We would like to know if this is the reason why the translator is off so often.

It seems that "codestore" does not work well; at the beginning of the experiment, it was only sending very slow speed RTTY signals, but now, it sends information in "clear" morse code. That information is clear at the beginning of the transmission but a few hours later, it becomes almost unreadable; we think it is probably cosmic bombardment which degrades signals stored in the memory, although we are not quite sure; maybe you can give us some more details about it. This would be helpful for us, to explain thereafter what is OK and what is wrong about the satellite, to our many friends here in France who wait for information!!

We also note propagation anomaly on the 70 cm signal: it is very often heard 2 to 3 minutes BEFORE AOS and also 2 to 3 minutes AFTER LOS. Some short computation indicates that the maximum distance, theoretically speaking, is about 4100 km, and in those cases, the 70 cm signal was still heard when the satellite was as far as 5500 km ground distance; at those moments the signals on ten meters were already in the noise.

Late information about signal quality on 10 m: quite often, at LOS in the 1200/1400 range, signals become extremely rough, as though reflected by aurora; we think it could be interesting to investigate. CW signals are about T4, T5, and SSB signals are unreadable. The phenomena happens about 80% of the time at LOS always around the time mentioned above. We never notice that phenomena at AOS, and also at LOS at other time, and other directions.

Miscellaneous:

On November 22, 1972, a storm destroyed half of the antenna system, the 4x9 element for 144 MHz; since November 25, a new antenna system has been operational: for 2m, it is a single 16 element antenna and for 10m, a 5 element full size yagi, as there was room enough on top of the tower!!

Results on the receiving side are terrific with the new 10m beam although this antenna is not tiltable; at AOS and LOS back signal is always about 40 to 45dB above noise, and signal from other stations are also very strong, and quite often heard BEYOND the horizon, when our own signal is not readable, because the 2m signal does not reach the satellite.

But unfortunately, we have not been able to do all the tests and measurements that we would have done, because the translator is off too often. So far it has not yet been possible to get exact information concerning what is wrong with the on/off system; some people say there is a safety device which switches off the translator when temperature is too high, on the PA stage; others say that the safety device switches off when the battery voltage is too low; others say it switches off when it is too high; and as a final information, some people also say that guys at ground stations are crazy!!

So far it is impossible to get any official information concerning the switching device. W1AW sends information too late in the night, and the official AMSAT station was never heard here. QST magazine comes here with one or two months delay, and so we are quite in the dark.

Due to this fact, many stations got rid of listening to noise, and specially those who have no orbital data available. We got several letters from fellows who were quite enthusiastic at the beginning, who said that they have not so much time to lose by listening to the "void," and so they gave up. It is the case of some friends of "Eastern" Europe, some Swedes, Dane, French and some German. Now, in Europe, it only remain the "hard-to-give-up" fellows, those who are accustomed to listen to nothing but nothing!! Those fellows who are always QRV, 100% of the time are: EI6AS, HG5AIR, SM6PU, FLYS, F3NB, DK2ZF, GW3FSP, LALK, EA4AO, DL9GU, FC6ABP, G6RH, G3PWJ, LZ1BW. Some other stations are also about 50% of time QRV: UA1DZ, UG6AD, UT5DL, OK3CDI, OK1MBS, SV1AB, SM5LE, SM5AIL, SM3BIU, SM2CFG, LA8WF, many F's and DL's, DM2BEL, I3LDS, I4NU and so on. Many others only appeared once or twice: TF3EA, UW6MA, SM5AIE, F5PL, OK1BMW/P, HG2RG, HG2RD, LA4YG, HB9OP, KB9QQ, 4X4MH and many others that we have forgotten.

Stateside, the most often heard and worked station here is K2RTH; then comes K1HTV; all others were worked or heard only once. From Canada, activity seems to be more regular: stations VE3QB, VE2BYG, VE3CUA and VE2DFO are very often heard but not so many QSO's with them, because they are often heard AFTER loss of back signal here!

It also seems to us that operating practice is very poor in the States, at least during a pass which can provide contacts with Europe: many W's call CQ CQ CQ CQ;... giving their call-sign only once and then ..K..; so you send a legitimate...??..., then the OM comes back QRZeding or sending your call-sign only but not his! One day, we heard W4FJ calling CQ for 4 minutes!! Probably most of them are quite anxious to make a QSO with Europe, and so they keep calling as soon as they get some reply. Therefore, when you are in QSO with a W, you are called by another one right when the one you are in QSO with gives you your report! We think that very short CQ's, not longer than 10 seconds, as well as short listening periods between CQ's are much better practice; on CW a speed of about 18 to 20 wpm is also a good value; faster CW is quite often "smoothed" by fast QSB, and are difficultly readable; slow speed CW is OK for very weak signals, but with good signal strength, it takes too much time to achieve a QSO. In SSB, due to Doppler shift, it is not easy to tune the signal, specially with fast speaking people; do not forget that people in Europe don't speak English as their mother tongue.

F5SE, REIMS

Notice to all Users of OSCAR 6

The OSCAR 6 satellite has been in orbit since October 15, 1972. Many hundreds of amateurs throughout the world have QSO'ed thru it. Design lifetime is one year and it is hoped that this goal will be exceeded, so many more contacts lie ahead. Many more contacts lie ahead, that is, if the satellite's nickel cadmium batteries can be kept charged. If discharge should proceed to a critically low point, one or more battery cells will become reversed. Once this happens the battery is ruined and OSCAR 6's life will quickly come to an end.

Due to the small dimensions of OSCAR 6, there is less space for solar cells to recharge the battery than the satellite's designers would have liked. As a result, a rather modest operating schedule has been established. This schedule, which will be adhered to until further notice, is as follows:

Satellite 2/10M translator ON 0000Z Thurs— 2400Z Mon
Satellite 2/10M translator OFF 0000Z Tues— 2400Z Wed.

There may be instances, during the OFF times, when the satellite may be found ON. This can be a result of a number of things. The translator may have been turned ON to receive telemetry data via the 29.45 MHz beacon. A problem which has occurred with the 435.1 MHz beacon now leaves 10M as essentially the sole source of telemetry data. Information from telemetry is crucial in assessing the condition of the satellite's battery and other vital parts. The translator could have been turned ON to conduct a controlled test. A clear satellite is important to the proper running of such tests. It is also possible that the translator may be ON unintentionally.

Use of the OSCAR 6 satellite when it may be encountered ON during a scheduled OFF period may hamper collection of telemetry data from the very weak 29.45 MHz beacon, may obstruct a special test and will lead to discharge of the battery when it should be charging. In all cases operation thru the satellite should be avoided during scheduled OFF periods. Please do not contact other stations to tell them to get off. You will only increase the load, and the stations may be participating in a controlled test. Instead of contacting them please send their calls and the time that they were logged to AMSAT.

AMSAT requests that now that you have this background information you will help out by refraining from operation during scheduled OFF periods in the future and that you will pass this information along to other stations.

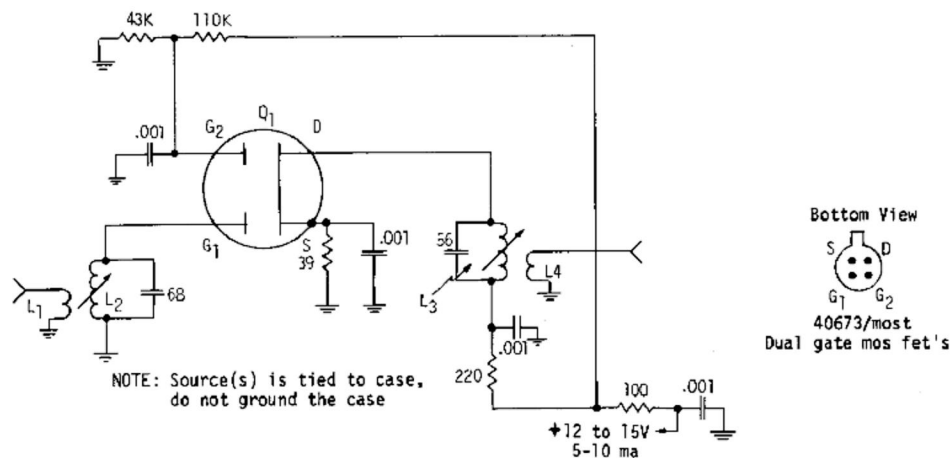
A PREAMPLIFIER FOR 29.5 MHz

by Jack Colson, W3TMZ

Probably the greatest problem most amateurs have with obtaining satisfactory two-way communications via the OSCAR 6 satellite is in hearing the 29.5 MHz downlink. If you are not able to copy the beacon on 29.45 MHz on an overhead pass or even passes that are somewhat removed from overhead, then your receiving system is not as good as it can and should be for satellite communications. Generally, most receivers' sensitivity is reduced considerably at 29.5 MHz for numerous reasons (poor noise-figure, inadequate gain, and poor impedance match). A good antenna will help, but a low noise preamplifier will do more to improve the receiving system than an elaborate antenna system. Generally, most receivers have noise figures ranging from 8 to 20 dB at 29.5 MHz (a good guess). With a properly operating and designed preamp the noise figure can be reduced to 2.5 dB and 15 to 20 dB of gain can be realized. Such a preamp will improve the receiving system sensitivity greatly. One important factor that must be dealt with now that the receiving system has been made super-sensitive is the susceptibility to overload, cross-modulation, etc. Unfortunately, this is almost always a problem with very sensitive receiving systems. This situation is even more profound with regard to OSCAR communications, i.e., simultaneous receiving and transmitting. Depending on the transmitters' operating characteristics (unwanted products) and proximity of the receiving/transmitting antennas; this problem will vary with each installation.

A number of preamps of the following design have been built. These have had measured noise figures ranging from 2.5 to 4.5 dB and power gains ranging from 15 to 22 dB. An absolute best design has not been attempted, but what has been built performs quite well.

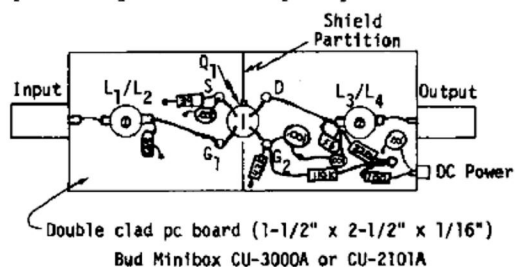
The schematic for the preamp is shown below.



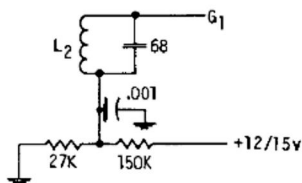
- L_1 - 2T No. 24E closewound over cold end of L_2
- L_2 - 10T No. 24E spaced wire diameter; 1/4" dia. slug tuned (RED)
- L_3 - 10T No. 24 closewound; 1/4" dia. slug tuned (RED) form, winding approx. 1/4" long
- L_4 - same as L_1
- Q_1 - RCA 40673

The layout of the components are not critical, but a shield partition across the device (dual-gate MOSFET) is desirable. Almost any dual gate MOSFET will work in this circuit. The devices that have protective diodes will have slightly poorer noise-figures but they do offer good transient protection and are easy to use. These devices are: 3N187, 3N200, 40673, 40819, 40820, etc. The 40673 is normally priced at \$1.01.

A simplified component layout for this preamp is shown below:



Using the coil/capacitor combinations shown in the schematic will produce a very low noise figure and excellent gain. In some cases it is necessary to reduce the gain of the preamp because the noise from it and the antenna will overload the receiver. Two simple methods of achieving this gain reduction are: use a pad (attenuator) on the output of the preamp or make a slight modification to the preamp: bias Gate No. 1. This is shown schematically:



The gain will decrease as G_1 is biased positively (6v maximum). In summary, this preamp will in most cases be a welcome addition to the receiving system.

"Range Measurements with OSCAR 6 Using Slow-Scan TV Equipment"

by Karl Meinzer, DJ4ZC

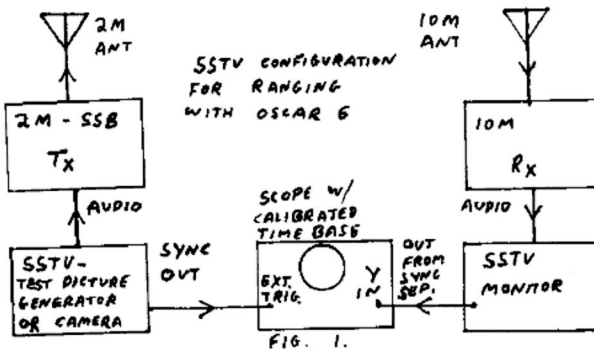
Trying to determine a satellite's equatorial crossing time, and particularly the longitude of equatorial crossing by simple means is a rather difficult job. On the other hand, with range data, these orbital parameters can be calculated after a single pass of the satellite.

Range information can be gathered by using the satellite's transponder. By measuring the time a radio wave takes to travel to the satellite and back, the distance to the satellite can be determined, since the speed of light is known to be 300 meters (1000 feet) per microsecond.

The range to the satellite will be between about 1500 and 4000 km (900 to 2500 mi.), giving delays from 5 to 13 milliseconds for one way, or 10 to 26 milliseconds for the round trip. If the desired accuracy of the satellite's equatorial crossing time and longitude is 10 seconds and 2/3 degree, respectively, then a ranging accuracy of 75 (~45 mi.) km is desirable, since the satellite travels at a speed on the order of 7 km/second (4-5 mi./sec.). In order to achieve this accuracy, the ranging timing error should not exceed 0.5 ms. From this, it is evident that the signal-delay within the satellite transponder, which is on the order of 10 microseconds, can be neglected. On the other hand, the delay introduced by the ionosphere over the ten meter downlink cannot be neglected, as will be seen later.

In order to investigate the ranging concept, a very simple arrangement was tried. Standard slow-scan television equipment has a line frequency of 15 Hz, corresponding to a 66.7 ms. period. The horizontal sync-pulses last 5 ms. It was felt that slow-scan test transmissions could provide a useful means to carry out ranging experiments.

The sync-pulses of a test transmission are used to trigger a scope line. The received sync-pulse is displayed on the scope (see Fig. 1). To do this, the output of the sync-separator of the monitor has to be made available. The line flyback pulse was tried, but it was found that this had too much jitter and it was impossible to tell the quality of the recovered pulse.

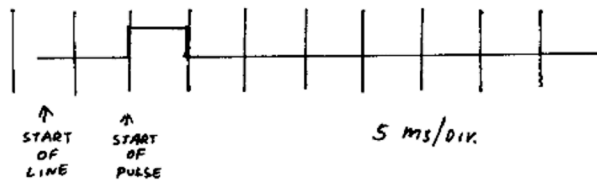


By using the sync-separator output of the monitor, any poor return quality is immediately evident on the pulse shape (it is shortened).

The systems must be calibrated in order to account for the various delays in the station. It was found that the transmitter and receiver introduce about 2 ms. delay, and the monitor another 2 ms. delay.

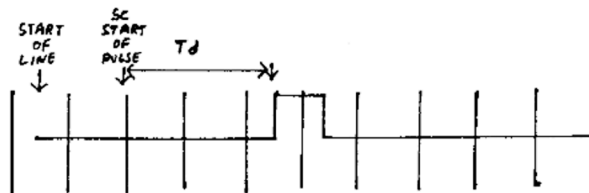
*Preprinted from QST.

By placing a converter in front of the ten meter receiver, the system can be run in a short-circuit or "back-to-back" mode. The line start of the scope should be adjusted in such a way that the displayed pulse starts at a grating reticle on the oscilloscope screen. Line start and pulse start should be noted.



SCOPE PATTERN IN SHORT-CIRCUIT ("BACK-TO-BACK") MODE
FIG. 2.

If the system is operated through the satellite repeater, the pattern will look like this:



SCOPE PATTERN IN RANGING MODE
FIG. 3.

During a period of good reception, the start of the received pulse should be marked and the time noted. (It's best to have a second operator do the writing and time recording for you). Now note the time delay (t_d) from the scope. About ten good measurements per pass are sufficient to get the necessary information.

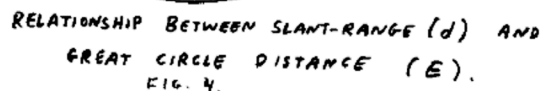
In order to calculate orbit information from these measurements, it is desirable to have a calculator. At first, the t_d 's are converted to distance by the formula

$$t_d (\text{ms.}) \times 150 = d (\text{km})$$

$$\text{or } t_d (\text{ms.}) \times 93 = d (\text{mi})$$

where d is the slant range distance to the satellite. In order to be able to transfer this distance into a chart, it has to be turned into a great-circle distance (Fig. 4)

$$E = r \cos^{-1} \left(1 - \frac{d^2 - h^2}{2r^2 + 2rh} \right) \approx \sqrt{\frac{d^2 - h^2}{1 + r/h}}$$



These E-values now can be used to construct a graph. First start by drawing a vertical line to represent the subsatellite track. Next, divide this line into about 25 equal distances, representing 1 minute intervals corresponding to 425 km (265 mi.) each. Choose a scale that is practical for the size of the page. Now set a compass to the first radius E_1 and draw a circle from the first time mark. The next distance is then taken by moving up an appropriate amount of time and drawing a circle with radius E_2 . You will finish having a figure as shown in Fig. 5.



The circles do not meet in one point, because the ionosphere introduces errors as high as 500 km (300 mi.) at ten meters, if the satellite is at a low angle above the horizon. Part of this error is cancelled by the approximations implied in the planar construction of this actually spherical problem, and by the approximation for the arc-cosine given in the above equation. In addition, you must make an educated guess at the station's position indicated by the small circle in the figure, the nearest measurement being the most accurate. From this graph it is easy to find the distance of closest approach and the time of closest approach, which can be used to set the orbital semicircle on a meteorological satellite plotting map. Working backwards, equator crossing time and longitude can be found. (Note that there are actually two ambiguous solutions, only one of which is correct).

South-to-north passes are most useful for calculating equator crossing data, while northeast-to-northwest passes can be used to check the system with known inclination, or to determine inclination.

The accuracy obtained is about one millisecond, which falls slightly short of the desired value, but nevertheless the system provides a reasonably accurate way available to amateurs to determine equator crossing information.

An advanced system is under construction using a 30 Hz tone modulated onto an audio subcarrier. By measuring the phase shift, it is hoped to increase the accuracy to the theoretical limit consistent with the ranging signal-to-noise ratio, this limit being about 0.3 ms.

Here are some results, taken by DJ4ZC on Orbit 215, on November 3, 1972 (station location: 50°49' North Latitude, 351°16' West Longitude).

Measurement number	Time (GMT)	Measured range (km)	Measurement number	Time (GMT)	Measured range (km)
1	2041:30	4087	9	2052:08	2512
2	2042:07	3637	10	2053:00	2663
3	2043:34	3337	11	2053:37	2888
4	2045:05	3038	12	2054:30	3188
5	2046:20	2663	13	2055:42	3412
6	2048:25	2438	14	2056:24	3788
7	2050:50	2438	15	2057:19	4013
8	2051:27	2438			

Using these data in the preceding equations, the following results were calculated:

Time of closest approach: 2049:30 GMT

Time of equatorial crossing: 2034 GMT

Longitude of equatorial crossing: 356.8° West.

These results compare favorably with NASA orbital predictions, which gave the time and longitude of equatorial crossing for Orbit 215 as 2033:26 GMT and 356.16° West, respectively.

AMSAT Board of Directors Meeting

January 11, 1973

The Board of Directors meeting was called to order by President Klein at 8:20 PM at the home of Jan King.

In attendance were Perry Klein K3JTE, Jan King W3GEY, George Kinal WA3TRL, Bill Tynan W3KMY, Charles Dorian W3JPT, Bill Hook W3QBC, Ray Solfer K2QEW, Dick Daniels WA4DGU and John Gregory W3ATE.

It was agreed that the next meeting would be on 30 January following the Experimenters Conference and prospective meeting of the Amateur Satellite Service Committee later this month.

Mr. H. Yoneda, JALANG was appointed as AMSAT liaison representative for Japan.

The attention of the Directors was called to the planned ARRL Technical Symposium on September 14th to be held in the Washington, D. C. area and the call for papers contained in the January issue of QST. It was agreed that AMSAT would encourage its members to submit papers and make a particular effort to solicit speakers from its more knowledgeable and active members. Secretary Dorian was appointed to coordinate these efforts.

President Klein reported on his informal meeting on January 10th with the officials of the American Satellite Corporation. A formal written report is under preparation. AMSAT is waiting for a formal reply to our letter sent to the Corporation concerning their use of the trademark "AMSAT." This item was tabled pending receipt of the letter.

Bill Tynan advised of a planned display of amateur satellites at the Johns Hopkins University Applied Physics Laboratory. He solicited the loan of various items for the exhibit.

The status of command stations for control of OSCAR 6 was discussed. It was agreed that Jan King should discuss with Dave Robinson K7BBO Dave's offer to assist as a second command station for the West Coast. Dave has also accepted the task as Chairman of the AMSAT Fund Drive activity.

Approval was granted to expend funds not to exceed \$100 for necessary expenses of the Canadian command station.

The Directors wish to acknowledge the service of many stations and individuals who have been responsible for the success of OSCAR 6. Larry Kayser and Dick Kolbly are particularly commended for their help during the past months in keeping OSCAR 6 operating.

Jan King made a presentation on the forthcoming Experimenters Conference scheduled for the end of the month. Karl Meinzer DJ4ZC of Germany, Dr. Peter Hammer VK3ZPI of WIA-Project Australis, Dick Kolbly of JPL California, John Goode of Texas and Lance Ginner of OSCAR California are expected to join in a series of intensive planning conferences and design reviews in preparation for AMSAT -OSCAR 7.

A short presentation was made on the present status of OSCAR 6. A reduction in the 435 beacon signal has just occurred. The reasons for this problem are being investigated.

The meeting adjourned at 11:45 PM.

Charles Dorian, W3JPT

AMSAT Board of Directors Meeting

January 30, 1973

The Board of Directors meeting was called to order by President Klein at 8:10 p.m. at the home of C. Dorian.

In attendance were Perry Klein K3JTE, Jan King W3GEY, Bill Tynan W3KMY, Chas. Dorian W3JPT, Bill Hook W3QBC, Ray Soifer K2QBW, Dick Daniels WA4DGU, Peter Hammer VK3ZPI and Karl Meinzer DJ4ZC.

President Klein reported on current activities, OSCAR 6 operations and the status of discussions with American Satellite Corporation. Appreciation was expressed for the allotment of funds from the ARRL and the donation of \$100 from the Foundation for Amateur Radio.

Bob Clark, the editor of the AMSAT Newsletter, advised he must resign due to the press of work. All Directors joined in expressing their appreciation for the excellent job Bob has done over the past two years.

President Klein reported on his meeting with the Patent Office representatives concerning the register of our mark -- AMSAT. The Patent Office was expected to act on this sometime in February.

The possibility of holding the Annual AMSAT meeting at either the ARRL Roanoke Division Convention, 15 - 16 September or the Cape Cod - New England Convention mid-September, was discussed. The Directors were inclined to believe the Roanoke Convention was a preferred choice. This will be further discussed and resolved at the next Directors meeting.

Summarized recommendations of the Experimenters Conference were received from Jan King. After discussion the recommendations were approved by the Board.

They are:

OSCAR A-O-B will have 3 translators, a 432/146 MHz unit by DJ4ZC and DJ5KQ, a 5-watt 146/29.45 MHz by AMSAT and a 1-watt 146/29.45 MHz by AMSAT. Additional equipment will be a beacon on 435.1 MHz, a Codestore unit and Morse code and RTTY telemetry encoders.

A second satellite, designated A-O-D will be built in Australia by the WIA - Project Australis group and will contain the Australis two-meter-to-70 centimeter FM repeater and other repeater and telemetry systems to be supplied by AMSAT.

Dick Kolbly K0HLD, was appointed as Spacecraft Structures Manager for A-O-B.

Charles Dorian, W3JPT

MINUTES OF AMATEUR SATELLITE SERVICE COMMITTEE MEETING

February 17, 1973

Arlington, Virginia

Status Report on AMSAT-OSCAR 6: Mr. Klein presented a status report on the AMSAT-OSCAR 6 satellite, noting that some problems with spacecraft temperatures have been encountered. The sporadic internal generation of command functions has required extensive planning and coordination among the several ground control stations to assure that the satellite is available during the advertised weekend periods, but is idled for recharging of batteries the remainder of the time. Present indications are that the one-year life expectancy will be reached and perhaps exceeded. Amateurs in fifty countries have sent signals through AO-6 thus far, and DJ4ZC has performed some ranging experiments, using SSTV, for elementary orbit measurement.

Status of Talcott Mountain Space Educational Program: Mr. Dannals reported that the third draft of the curriculum for use by teachers, contracted by AMSAT with Talcott Mountain Science Center, is now being reviewed. AMSAT carries responsibility for contract fulfillment, although the cost of the contract (\$2000) will be borne by A.R.R.L., as agreed previously. Delivery of a completed draft to A.R.R.L. Headquarters at the earliest possible date is considered imperative, so that arrangements can be made to reproduce copies and distribute them to schools throughout the U.S. and to other countries for experimental uses. Mr. Waters advised that A.R.R.L. has a promotional draft ready for use in connection with the curriculum when the latter becomes available for distribution.

The following committee position was adopted:

The Amateur Satellite Service Committee urges the earliest possible completion of the curriculum being prepared by the Talcott Mountain Science Center, in order to optimize opportunities for its effective use during the current and ensuing school year.

It was agreed that the initial distribution should be at no cost to the teachers, but that a nominal price might be assigned to the curriculum and an actual charge made by A.R.R.L. for furnishing additional copies (or in other special circumstances.) AMSAT is to undertake to expedite completion of the manuscript.

A.R.R.L. Progress Report: Mr. Dannals advised that the A.R.R.L. Board of Directors ad hoc Satellite Committee has been directed to study the possible establishment of a tracking station at A.R.R.L. Headquarters (Minute 52, January 1973 Board Meeting). He reported that there are severe interference problems at the Headquarters site because of the several WLAW transmitters in use there, and that consideration will also be given to the possibility of remotely-controlling the Talcott Mountain facilities from the Headquarters site.

Mr. Waters described the results of his visits with AMSAT and OSCAR officials and indicated that general concurrence was obtained from the two groups regarding A.R.R.L. plans to obtain both press coverage of satellite activities and to seek means for attracting and involving young people in amateur satellite activities through local clubs and by means of newsletters to secondary school science teachers.

Mr. Dannals advised that Captain Charles Dorian, W3JPT, has agreed to manage the A.R.R.L.'s Technical Symposium, which is to be held on Friday, September 14, 1973, at Reston, Virginia (near Washington, D. C.). The symposium will have space communications as a central theme and is being held in conjunction with the Roanoke Division A.R.R.L. Convention (which will occupy the same site the following two days).

Mr. Klein affirmed that AMSAT plans to assist in the planning and staging of the symposium, and may reschedule its annual meeting to coincide with the symposium/convention weekend, to immediately follow the termination of convention activities on Sunday afternoon.

AMSAT Progress Report: Mr. Klein described the status of AMSAT organizational affairs, reporting that a proposal to create a salaried position for an executive director of AMSAT had been extensively discussed but has not been implemented for financial reasons. Career preoccupations by key AMSAT personnel may bring about some deceleration of program activities on AO-7 and AO-8, although he emphasized that there is no lessening of enthusiasm or determination. AMSAT membership now is nearly 1000. Design and construction of future satellites will be aimed at achieving three-year lifetimes. Preempting of AMSAT's abbreviated title by a commercial concern, the American Satellite Corporation was described. AMSAT is exploring its legal claim to the name.

OSCAR Progress Report: Mr. Vincent provided copies of OSCAR's new organization chart and described reorganizational activities. He stated that OSCAR will continue to be essentially volunteer in make-up, although employment of technicians will be considered if OSCAR goes into an operational mode. Any such step would be in close cooperation with the efforts of AMSAT. Mr. Vincent indicated that OSCAR encourages the establishment of a satellite station (or control point) at A.R.R.L. Headquarters, and advised that contact will be made with Mr. Pete Hoover regarding the resumption of discussions on the Hoover Memorial Station as a possible west coast control point for amateur satellite programs. Mr. Vincent reported that OSCAR will continue to be alert for launch possibilities for future satellites, adding that two launches per year is regarded by OSCAR as a desirable goal. Cooperation from industry will be sought in connection with obtaining donations of components and use of test facilities.

Mr. Vincent also provided copies of OSCAR's recently-developed Spaceframe Proposal, which is intended to minimize risks and uncertainties associated with the physical adaptation of AMSAT and OSCAR space hardware to the resources available in the launch vehicle. This effort at standardization is regarded with enthusiasm by the AMSAT representatives, and direct coordination between AMSAT and OSCAR of the technical details will follow, pending an opportunity for AMSAT study of the proposal.

Possible Space Use of 1215 to 1300 MHz Region: Mr. Klein described efforts being made by AMSAT to foster use of the 1215-1300 MHz and 2300-2450 MHz amateur bands for low-power beacon use. The desirability of supporting efforts to secure support for these efforts was acknowledged, inasmuch as the potential for interference to shared users of these bands is negligible and the effectiveness of earth station control of amateur satellite transmissions has been conclusively demonstrated.

Mr. Vincent indicated that OSCAR supports this probing approach to the use of new frequencies for amateur satellite work. It was the sense of the participants in the meeting that these voluntary efforts should be supported and encouraged. Direct and continuing coordination among AMSAT, OSCAR and A.R.R.L. is urged in support of their objectives.

Publication of Amateur Space Activity: Mr. Klein stressed the need for additional coverage of satellite equipment and techniques in the Radio Amateur's Handbook, noting that fewer than three pages are devoted to this in the 1973 issue. Mr. Huntoon explained the basis for allocating space in the Handbook to the various areas of amateur specialization, and it was noted that consideration is being given to publication of a "special techniques" handbook which could include more extensive coverage of satellite and space communications. He noted that no satellite article has yet been rejected for use in QST.

The forthcoming A.R.R.L. Technical Symposium was cited by Mr. Dannals as a promising vehicle for bringing attention to the activities of radio amateurs in the satellite communications field. Following a discussion of the matter, Mr. Dannals requested Mr. Clark to prepare a letter to the chairman of the A.R.R.L.'s Contest Advisory Committee to ask that group to study and make recommendations for changes in the A.R.R.L. Field Day and VHF Contest Rules (but not Sweepstakes or DX Contests) to encourage making of contacts through AO-6 during those affairs.

The next ASSC meeting will be held at 9:00 a.m., June 16, 1973, at Arlington, Virginia.

Operations

by Bill Tynan W3KMV

The happy word has pretty well gotten out by now but for those who haven't heard it, the OSCAR-6 operating schedule has been increased two days. The satellite is now ON for two-way contacts from 0000Z Thursdays to 2400Z Mondays. Satellite users are reminded not to attempt to use OSCAR-6, even if they should hear it ON during the scheduled OFF periods, 0000Z Tuesdays through 2400Z Wednesdays. The satellite may be ON for special experiments, telemetry data collection or because of some inadvertent cause. Collection of telemetry data, the success of special tests and sufficient battery charge require stations to refrain from using the satellite during scheduled OFF periods. As reported elsewhere in this Newsletter, the 435.1 MHz beacon has ceased to function properly. Therefore, the 29.45 MHz beacon is now the only source of telemetry. Use of the satellite often makes copy of this beacon difficult because of the power sharing nature of the 2/10 meter translator power amplifier stage.

Remember also that effective radiated power in excess of 100 watts is unnecessary and unsportsmanlike. All excessive power does is to depress the gain of the satellite's translator and reduce the strength of the other signals in the passband. Many successful users have found that a 50-100 watt transmitter and a dipole or crossed dipoles make a good combination. Such an installation eliminates the need for pointing the antenna. This facilitates operating through the satellite considerably.

Observation indicates that a consistent problem is poor ground receiving installations on 10 meters. This may be one reason why some users run too much power. They keep turning up the wick until they hear a good signal on the downlink. There is a better approach, one which also helps in the reception of other stations through the satellite. That is improvement of 10 meter receiving performance by the use of a better antenna or the installation of a preamp in

front of the old receiver. Jack Colson, W3TMZ, has developed a very effective PET preamp costing less than \$10 to build and requiring only a couple of hours to put together. See his article describing it in this issue.

Again, in this Newsletter, we are publishing one reference orbit per day for the next six months. Comparison with data in the last Newsletter will show slight differences. The data contained in the accompanying table represents new updated information from that published in December.

To produce orbital information for other than the reference orbits, simply keep adding 115 minutes and 28.75 degrees for each succeeding orbit.

The following are a few tips for computing orbits.

W5SXD suggests that, for those using calculators, to compute the time for the next orbit, add 195. At the point where you get an obviously incorrect answer such as 0595, simply subtract 40 and the next orbit time is 0555. You can then continue adding 195 for succeeding orbits.

W3LUL suggests that for those who wish to calculate the longitude for the descending node (north to south equator crossing) from the usual ascending node data, use the following formula:

$$\text{Lat}_D = 194.375 + \text{Lat}_A$$

where

Lat_D is the descending node latitude

Lat_A is the ascending node latitude.

If the answer is over 360°, subtract 360°.

T= 114.9944 L'= 28.7486
REV DATE TIME Z LONG W

2096 APR	1	0138.2	72.1	2471 MAY	1	0021.1	52.8
2108 APR	2	0038.1	57.1	2484 MAY	2	0116.1	66.5
2121 APR	3	0133.0	70.8	2496 MAY	3	0016.0	51.5
2133 APR	4	0033.0	55.8	2509 MAY	4	0110.9	65.2
2146 APR	5	0127.9	69.5	2521 MAY	5	0010.8	50.2
2158 APR	6	0027.8	54.5	2534 MAY	6	0105.8	63.9
2171 APR	7	0122.8	68.2	2546 MAY	7	0005.7	48.9
2183 APR	8	0022.7	53.2	2559 MAY	8	0100.6	62.6
2196 APR	9	0117.6	66.9	2571 MAY	9	0000.6	47.6
2208 APR	10	0017.6	51.9	2584 MAY	10	0055.5	61.3
2221 APR	11	0112.5	65.6	2597 MAY	11	0150.4	75.1
2233 APR	12	0012.4	50.6	2609 MAY	12	0050.4	60.1
2246 APR	13	0107.4	64.3	2622 MAY	13	0145.3	73.8
2258 APR	14	0007.3	49.3	2634 MAY	14	0045.2	58.8
2271 APR	15	0102.2	63.1	2647 MAY	15	0140.2	72.5
2283 APR	16	0002.2	48.0	2659 MAY	16	0040.1	57.5
2296 APR	17	0057.1	61.8	2672 MAY	17	0135.0	71.2
2309 APR	18	0152.0	75.5	2684 MAY	18	0035.0	56.2
2321 APR	19	0051.9	60.5	2697 MAY	19	0129.9	69.9
2334 APR	20	0146.9	74.2	2709 MAY	20	0029.8	54.9
2346 APR	21	0046.8	59.2	2722 MAY	21	0124.7	68.6
2359 APR	22	0141.7	72.9	2734 MAY	22	0024.7	53.6
2371 APR	23	0041.7	57.9	2747 MAY	23	0119.6	67.3
2384 APR	24	0136.6	71.6	2759 MAY	24	0019.5	52.3
2396 APR	25	0036.5	56.6	2772 MAY	25	0114.5	66.1
2409 APR	26	0131.5	70.4	2784 MAY	26	0014.4	51.0
2421 APR	27	0031.4	55.3	2797 MAY	27	0109.3	64.8
2434 APR	28	0126.3	69.1	2809 MAY	28	0009.3	49.8
2446 APR	29	0026.3	54.0	2822 MAY	29	0104.2	63.5
2459 APR	30	0121.2	67.8	2834 MAY	30	0004.1	48.5
				2847 MAY	31	0059.1	62.3

2860	JUNE	1	0154.0	75.9
2872	JUNE	2	0053.9	60.9
2885	JUNE	3	0148.8	74.6
2897	JUNE	4	0048.8	59.6
2910	JUNE	5	0143.7	73.4
2922	JUNE	6	0043.6	58.3
2935	JUNE	7	0138.6	72.1
2947	JUNE	8	0038.5	57.1
2960	JUNE	9	0133.4	70.8
2972	JUNE	10	0033.4	55.8
2985	JUNE	11	0128.3	69.5
2997	JUNE	12	0028.2	54.5
3010	JUNE	13	0123.1	68.2
3022	JUNE	14	0023.1	53.2
3035	JUNE	15	0118.0	66.9
3047	JUNE	16	0017.9	51.9
3060	JUNE	17	0112.9	65.6
3072	JUNE	18	0012.8	50.6
3085	JUNE	19	0107.7	64.4
3097	JUNE	20	0007.7	49.3
3110	JUNE	21	0102.6	63.1
3122	JUNE	22	0002.5	48.1
3135	JUNE	23	0057.4	61.8
3148	JUNE	24	0152.4	75.5
3160	JUNE	25	0052.3	60.5
3173	JUNE	26	0147.2	74.2
3185	JUNE	27	0047.2	59.2
3198	JUNE	28	0142.1	73.0
3210	JUNE	29	0042.0	57.9
3223	JUNE	30	0137.0	71.7
3235	JULY	1	0036.9	56.6
3248	JULY	2	0131.8	70.4
3260	JULY	3	0031.7	55.4
3273	JULY	4	0126.7	69.1
3285	JULY	5	0026.6	54.1
3298	JULY	6	0121.5	67.8
3310	JULY	7	0021.5	52.8
3323	JULY	8	0116.4	66.5
3335	JULY	9	0016.3	51.5
3348	JULY	10	0111.3	65.2
3360	JULY	11	0011.2	50.2
3373	JULY	12	0106.1	64.0
3385	JULY	13	0006.0	48.9
3398	JULY	14	0101.0	62.7
3410	JULY	15	0000.9	47.7
3423	JULY	16	0055.8	61.4
3436	JULY	17	0150.8	75.1
3448	JULY	18	0050.7	50.1
3461	JULY	19	0145.6	73.8
3473	JULY	20	0045.6	58.8
3486	JULY	21	0140.5	72.5
3498	JULY	22	0040.4	57.5
3511	JULY	23	0135.3	71.3
3523	JULY	24	0035.3	56.2
3536	JULY	25	0130.2	70.0
3548	JULY	26	0030.1	55.0
3561	JULY	27	0125.1	68.7
3573	JULY	28	0025.0	53.7
3586	JULY	29	0119.9	67.4
3598	JULY	30	0019.9	52.4
3611	JULY	31	0114.8	66.1

3623	AUG	1	0014.7	51.1
3636	AUG	2	0109.6	64.8
3648	AUG	3	0009.6	49.1
3661	AUG	4	0104.5	63.6
3673	AUG	5	0004.4	48.5
3686	AUG	6	0059.4	62.3
3699	AUG	7	0154.3	76.0
3711	AUG	8	0054.2	61.0
3724	AUG	9	0149.1	74.7
3736	AUG	10	0049.1	59.7
3749	AUG	11	0144.0	73.4
3761	AUG	12	0043.9	58.4
3774	AUG	13	0138.9	72.1
3786	AUG	14	0038.8	57.1
3799	AUG	15	0133.7	70.9
3811	AUG	16	0033.7	55.8
3824	AUG	17	0128.6	69.6
3836	AUG	18	0028.5	54.6
3849	AUG	19	0123.4	68.3
3861	AUG	20	0023.4	53.3
3874	AUG	21	0118.3	67.0
3886	AUG	22	0018.2	52.0
3899	AUG	23	0113.2	65.7
3911	AUG	24	0013.1	50.7
3924	AUG	25	0108.0	64.4
3936	AUG	26	0008.0	49.4
3949	AUG	27	0102.9	63.2
3961	AUG	28	0002.8	48.1
3974	AUG	29	0057.7	61.9
3987	AUG	30	0152.7	75.6
3999	AUG	31	0052.6	60.6
4012	SEPT	1	0147.5	74.3
4024	SEPT	2	0047.5	59.3
4037	SEPT	3	0142.4	73.0
4049	SEPT	4	0042.3	58.0
4062	SEPT	5	0137.3	71.7
4074	SEPT	6	0037.2	56.7
4087	SEPT	7	0132.1	70.5
4099	SEPT	8	0032.0	55.4
4112	SEPT	9	0127.0	69.2
4124	SEPT	10	0026.9	54.2
4137	SEPT	11	0121.8	67.9
4149	SEPT	12	0021.8	52.9
4162	SEPT	13	0116.7	66.6
4174	SEPT	14	0016.6	51.6
4187	SEPT	15	0111.6	65.3
4199	SEPT	16	0011.5	50.3
4212	SEPT	17	0106.4	64.0
4224	SEPT	18	0006.3	49.0
4237	SEPT	19	0101.3	62.7
4249	SEPT	20	0001.2	47.7
4262	SEPT	21	0056.1	61.5
4275	SEPT	22	0151.1	75.2
4287	SEPT	23	0051.0	60.2
4300	SEPT	24	0145.9	73.9
4312	SEPT	25	0045.9	58.9
4325	SEPT	26	0140.8	72.6
4337	SEPT	27	0040.7	57.6
4350	SEPT	28	0135.6	71.3
4362	SEPT	29	0035.6	56.3
4375	SEPT	30	0130.5	70.1

REDUCTION TO OTHER LATITUDES AND HEIGHTS

LAT MINUTES				LAT MINUTES			
N	PLUS	L	HT	S	PLUS	L	HT
		CORR	KILOM			CORR	KILOM
SN 0	0.00	0.00	1452.7	NS 0	57.41	194.33	1458.2I
SN 10	3.23	2.39	1452.3	NS 10	60.65	197.23	1459.7I
SN 20	6.47	5.92	1453.0	NS 20	63.91	200.26	1462.2I
SN 30	9.73	9.27	1454.7	NS 30	67.17	203.61	1465.4I
SN 40	13.02	13.22	1457.2I *	NS 40	70.47	207.55	1469.0I
SN 50	16.35	18.31	1450.1I	NS 50	73.81	212.64	1472.5I
SN 60	19.77	25.26	1462.9I	NS 60	77.24	220.17	1475.8I
SN 70	23.44	40.35	1455.5I	NS 70	80.92	234.59	1478.2I
SN 75	25.64	56.67	1466.5I	NS 75	83.13	250.31	1479.0I
N PT	28.69	96.98	1467.5I	S PT	86.19	290.98	1479.1I
NS 75	31.74	137.44	1467.5I	SN 75	89.25	331.58	1478.1I
NS 70	33.94	153.86	1467.1I	SN 70	91.45	348.10	1476.7I
NS 60	37.62	168.41	1465.5I	SN 60	95.14	2.73	1473.2I
NS 50	41.04	175.99	1463.5I	SN 50	98.56	10.33	1469.2I
NS 40	44.37	181.09	1461.4I	SN 40	101.90	15.45	1464.9I
NS 30	47.66	185.05	1459.5I	SN 30	105.19	19.41	1460.7I
NS 20	50.92	188.40	1458.2I	SN 20	108.45	22.77	1457.1
NS 10	54.17	191.44	1457.7I	SN 10	111.70	25.80	1454.3
NS 0	57.41	194.33	1458.2I	SN 0	114.99	28.74	1452.7

PT

*NOTE: "I" indicates that the OSCAR 6 satellite is in sunlight.

Frequency Selection for AMSAT-OSCAR-B (OSCAR 7)

As presently envisioned, AMSAT-OSCAR-B (A-O-B) will incorporate three communication translators -- a 70 cm-to-2m translator and two covering the 2m-to-10m range, one with somewhat higher power than the present OSCAR 6 plus another, more or less identical to OSCAR 6, which will be used as a "backup" system should it become necessary during A-O-B's projected lifetime of three years. Of the three translators, only one will be operative at any one time.

Present plans call for the 70cm translator to incorporate an uplink range of 432.125 to 432.175 MHz and a downlink range of 145.925 to 145.975 MHz. The unit will employ frequency inversion, so that, neglecting Doppler shift, an input signal at 432.125 will be retransmitted by the satellite at 145.975; an input signal using upper sideband will be retransmitted as lower sideband. When this translator is in use, a telemetry and Codestore beacon will be heard at 145.980 MHz.

The 2m-to-10m translators will employ identical frequency bands. The uplink range will be the same as OSCAR 6, 145.900 to 146.000 MHz. As with OSCAR 6, frequency inversion will not be used. The 2-10 mode will incorporate two beacons, as with OSCAR 6--one at 435.100 MHz, the other at a frequency in the 10m band to be decided.

In addition to the OSCAR 6 configuration, in which a beacon at 29.450 MHz is used in conjunction with a downlink range of 29.450 to 29.550 MHz, two other alternatives are under active consideration. Were it to be deemed desirable for the beacon to remain at 29.450, the downlink range could be shifted to 29.450 to 29.450 MHz. Alternatively, the beacon could be moved to 29.500 and the downlink placed at 29.400-29.500 MHz. Many users have expressed regret that the OSCAR 6 downlink extends above 29.500 MHz, since tuning that range is inconvenient with several popular receivers in current use. As a consequence, OSCAR 6 activity has been concentrated in the lowest 50 kHz of its passband.

AMSAT welcomes comments and suggestions from the amateur community concerning these frequencies planned for OSCAR 7. Please address comments to K2QBW in care of AMSAT, Box 27, Washington, D. C. 20044.

ANOTHER SYSTEM FOR TRACKING OSCARS

by Wally Lamb, WØPHD

It has been suggested that more information should be made available on how to track OSCAR 6. There have been a number of articles written on the subject but it appears that they leave something to be desired to the newcomer in the ability to visualize the orbits and determine when and where it is in relation to their QTH.

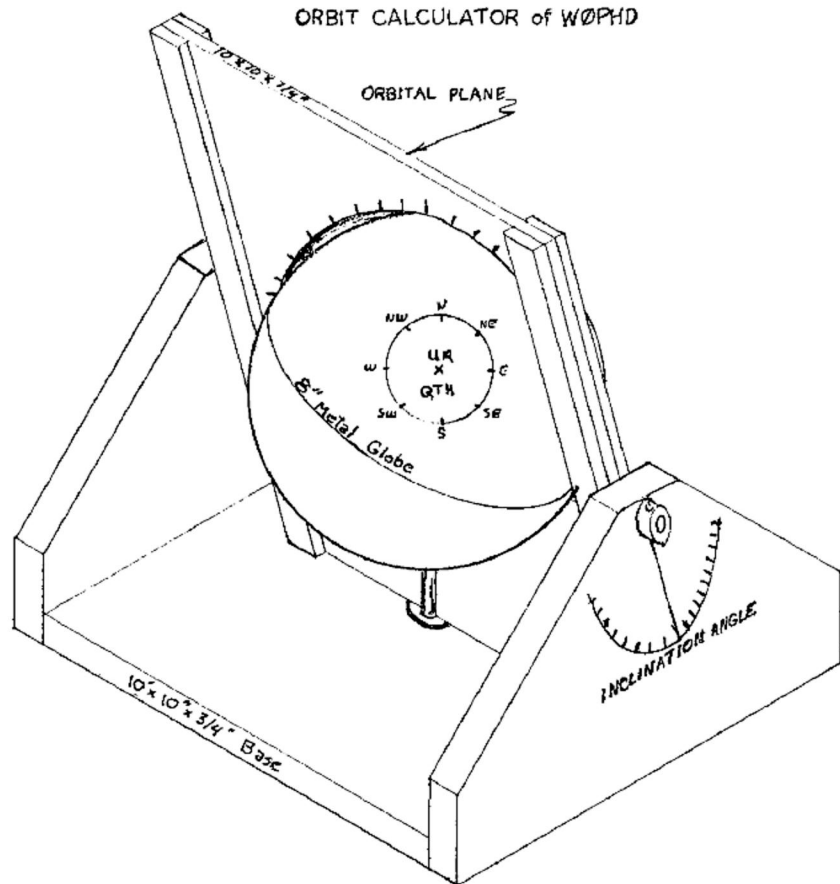
Here is the system which we have been using since OSCAR 3, and it is versatile enough to be used for other future OSCARS that have a near circular orbit. We have also found out that with the aid of this calculator students can easily grasp the concept that the orbital plane is stationary and the earth revolves within it.

The calculator is made up of four boards and a metal globe. First you drill holes into the globe at the north and south poles and insert a shaft thru these holes forming a North-South Axis. This shaft is then mounted on a base in such a manner that it is free to rotate. On the side of the base are two triangular supports which hold the board we call the orbital plane. This plane is made to tilt from near vertical to horizontal, thus any orbital inclination can be simulated. The orbital plane board contains calibrations that mark the time interval that has elapsed from the time of the ascending orbital crossing to any latitude. In the case of OSCAR 6 we know that it travels at the rate of 115 minutes per orbit (360 degrees); therefore, we can figure that the satellite travels at the rate of 3.13 degrees per minute and use this figure to mark off the time on the orbital plane board. In our case we mark off at 9.4 degree increments (3-minute intervals). In addition we know that the earth moves in a westerly direction at a rate of 15 degrees per hour, so for every four minutes of orbit the earth moves in a westerly direction one degree. This is also marked off on the orbital plane.

The globe is also calibrated in the following manner: you mark off a circle whose radius corresponds to the limit at which you can see the OSCAR. In the case of OSCAR 6 this is about 2500 miles. This corresponds to roughly a circle whose diameter is 62 degrees as measured on your globe at the equator. The center of this circle is at your QTH. Now, around the periphery of this first acquisition circle you mark off the compass bearings: N, NNE, NE, etc.

This is how it works: you locate the point on the equator that corresponds to the equatorial crossing in degrees WEST Long. You place the globe in this position so that the orbital plane crosses the equator at this point on the ASCENDING node. You then observe where the orbital plane first touches your first acquisition circle and the bearing. Note also the number of degrees the earth has rotated while reaching this point and rotate the earth a like amount to correct for the earth rotation. We can also get a pretty good idea of the elevation by noting how far the orbit path is from our location to the line of first acquisition; if it is half-way in, we know that the OSCAR will appear at about 45 degrees above the horizon at this point. You can also tell where you can expect to work someone from any given area by noting when their acquisition circle laps over yours giving you the bearing and duration of the path that will be most productive. With a little practice you will come up with a series of notes on a path like this. With an equatorial crossing of 30 degrees the orbital plane comes into contact with my first acquisition at plus 15 min. in a ENE direction, will be NE at 20 minutes, NNE at 23 minutes, North at 25 minutes and LOS at 30 minutes after crossing in a NNW direction. The beams will have to be elevated at about 30 degrees at mid-point of the path, and we have a good chance of working Europe when in the E and NNE.

ORBIT CALCULATOR of WØPHD



LETTERS

Dear Sirs:

I am writing on behalf of the Council and members of the Radio Society of Great Britain to offer you and your fellow amateurs, particularly your associates in AMSAT, congratulations on the successful launch of OSCAR 6 in October of last year. I personally believe that if amateur radio is to flourish and our continued occupancy of spectrum space is to be preserved, we must keep up with the times and make our contribution to developing communications technology. The progress which you and your colleagues have achieved is greatly to be admired and we in the RSGB wish you further success in your future endeavours.

Yours sincerely,
J. A. Saxton, President
London, England
Jan. 23, 1973

Dear Sirs:

I would like to make a few comments on the future goals of AMSAT, if I may. The editorial in the newsletter provoked a few thoughts. Since Amateur Radio is (or should be to some degree) devoted to communication in the interest of public service worldwide, I feel that communication via Amateur satellites should tend to provide this same service through emergency communications, international phone patching (of a non-commercial unimportant nature) plus serving as a reliable means through which to discuss the technical aspects of radio communication in general (nets, round-table discussions, etc.).

This should not be the whole story, however. Those of us who are interested in the technical side of our hobby should endeavour to provide the best quality communication system through which others will be able to provide this public service. As Bob Clark mentions in his editorial, this will provide satisfaction in the form of a well engineered satellite for the technically minded and the satisfaction of being able to provide a public service, in whatever form via a reliable medium, for the public service minded Amateur.

The possibility of reliable public service/educational communications via Amateur satellites is a very real probability. The use of geo-stationary satellites developed by Amateurs and situated over oceans or continents will be able to provide a continuous medium without the present problems of Doppler shift, antenna tracking and limited communications time. This type of project could provide a very interesting and major goal for AMSAT membership.

As for the present I feel some of the challenges are to investigate all forms of HF propagation which may affect satellite communication; to provide some form of tracking system for antennas (especially VHF and UHF highly directional arrays) by "programming" in orbit data; and to investigate forms of AFC suitable for reducing the drastic effects of Doppler shift, particularly to SSB signals. These should help improve the quality and reliability of signals through future orbiting OSCAR satellites--most worthwhile goals indeed.

Bill Shrimpton
VE7AZL
Jan. 9, 1973

Dear Sirs:

Concerning the letter by WA9HCZ:

The second paragraph refers to a type of operation that may exist in some countries. Myself, for one, I enjoy the freedom that Amateur Radio has to offer, talking when I please and to whom I please, and on what frequency I pick (operating under the Government rules).

We have done a good job in the past of policing ourselves and I see no reason why we can't do so in the future.

As far as the bedlam goes, this past weekend (January V.H.F. Contest) was a beautiful example of Q.R.M.; you couldn't find any worse on any band, and with 10 watts E.R.P. I worked stations. I think one major problem is operating technique. I'm not advocating that I know how to operate but 800+ QSO's on OSCAR 6 must mean something; 95% have taken place with 100 watts E.R.P. There are lots of good operators, I could list dozens, all I have to do is breathe and they hear me.

Please don't get me wrong when I say that I can operate when I please or that I disagree with AMSAT's shutdown times, I think that this is a real necessity.

Concerning the letter by K4TI (whom I've chatted with many times):

A bigger turnout, I think, really should be the last thing you would have in mind, after viewing the activity that OSCAR 6 has enjoyed since coming to life on Oct. 15. I think participation has been greater than expected.

Contest-wise, I don't feel any special consideration should be given to the operating times of the satellite, special points or what have you. If the stations wish to use the satellite as a means of getting extra points, etc., then it should be of his own doing, not by dangling a carrot in front of the rabbit trick. This rabbit doesn't need the carrot. I'm 250 miles away from the nearest V.H.F. station and in a contest that's murder. I took Quebec in June 1972 VHF contest, not by much but it was there for the taking.

As far as DXCC satellite, and WAS satellite go, WAS is a problem because of KH6 being out of range. It doesn't stop me from trying, I think it can be done.

If there was more activity from other countries, I'm sure DXCC might even take place with the existing spacecraft, at an altitude of 910 miles. All we can do is try.

Now, a few words of my own. OSCAR 6 to me is a new experience; not having much to do with the previous OSCARs, it's a new frontier for most of us. A lot of us have to review our thinking along the lines of, the more power the better, the bigger the antenna the better; horizontal and vertical polarization, these are gone with the spark gap. Circular is the way to go. Tracking the satellite from AOS to LOS is a chore in itself, but it's possible, and I still have time to operate although at times I wish I had 4 hands and 2 heads.

In writing I want to wish AMSAT the best of luck in 1973 with OSCAR 6 and future endeavors with my continuing support.

73
Randall S. Smith
VE2BYG
Alouette, P.Q., Canada
January 8, 1973

Dear Sirs:

I concur with others that the power of the AMSAT 2-10 meter repeater should be increased to five or ten watts. The downrange signals of OSCAR 6 are quite weak, even with good receiving set-ups. Also, it is apparent to me that most Europeans do not use good receiving equipment. I have called many of them but have not received any replies. Many of these times OSCAR was closer to them than to me, and I could still hear my own downlink signal. A six to ten dB increase in repeater output power should help this situation.

Second, I would like to see the frequency of the proposed ten meter auxiliary beacon moved to outside the main bandpass of the repeater, say 29.35 MHz. This way it won't get clobbered by other stations using the repeater. Along the same lines it should also be possible to move the internal beacon down to about 29.42 MHz, feeding a somewhat stronger oscillator signal to the driver transistor. I have never heard anybody down that far, yet it is not down very far on the passband skirts. It would also be helpful if the auxiliary beacon could be operated simultaneously with the 2-10 repeater. If, then, the internal beacon failed, the auxiliary beacon could be turned on without interrupting repeater operation.

The uplink to the Euro-OSCAR linear repeater should be moved to the new satellite band at 435-438 MHz. This would reduce the possibility of interference from casual operations on 432 MHz. It would also be more consistent, i.e., all satellite operations in the 70 CM band will be at 435 MHz, not split, as now.

Lastly, I am opposed to including the 146-435 MHz FM repeater. There is going to be extreme competition for its four channels, judging by the activity of OSCAR 6. This, in turn, will precipitate a power race such that only those with kilowatts and large beams will be able to work through the repeater. Its weak downlink signals will also contribute to the power race. The operation of this repeater simultaneously with a high power AMSAT 2-10 meter repeater would create such a heavy demand on the power system that the entire satellite would have to be shut down as or more frequently than OSCAR 6. The alternative, cycling the three repeaters, one each day, would be very confusing to the average amateur. Many antennas are still having difficulty keeping track of OSCAR 6; if they also have to keep track of which repeater is on, I think many will just give up.

Thanks for listening and hope to hear you on OSCAR 6.

73
Robert Crumrine
WB2DNN
January 20, 1973

Dear Sirs:

Enclosed are 6 report sheets (3 for QSO's and 3 for stations heard) covering the period October 15, 1972, to February 4, 1973, and a photograph of antennas used for communications via OSCAR 6.

Here are a few comments:

- 1) OSCAR 6 signals were first heard on October 15, at 18:35Z, i.e., a few minutes after orbital injection.
- 2) Telemetry signals are received on 29.450 and 435.1 MHz and complete sequences are now obtained, as QSB is slower than it was during days following launch.
- 3) Satellite rotation is becoming slower and slower, but it seems to me that the Magnetic Attitude Stabilization System has taken a longer time to stabilize the satellite than it did with OSCAR 5.

As a matter of fact, OSCAR 5 has been stabilized in 7 or 10 days, and it took more than a month to achieve same stabilization with OSCAR 6.

- 4) During the 2 first days following launch, I tried to make contacts with low power (10 watts in the 2x crossed g Elements). I heard sometimes my signal but could not complete a QSO.

So, from Oct. 17 to Oct. 19, I used relatively high power (80 watts to antenna) and completed several 2 way QSO's, and became more acquainted with azimuth and elevation tracking.

Since Oct. 20, all QSO's have been completed using low power (10 to 25 watts): so I think lack of practice in tracking satellite and in operations was the reason why I could not succeed during 2 first days.

Another reason was perhaps lack of practice of other stations, too, because I received QSL's from SWL's reporting reception of my signals during this period (Oct. 15 to Oct. 17.).

- 5) I think a lot of stations are using too much power and poor receivers (some stations are often overloading the satellite, specially during near overhead pass).

- 6) Telemetry values seem normal (except sometimes for unusual high current and battery discharge). However, one of the batteries is less charged than the other one.

Translator is working fine, without any troubles: actually, its output is very often between 500 mW and 800 mW.

- 7) I retransmitted on 2 meters news of launch as received from K1LPL/3 and now I transmit one time a week orbital predictions calculated here. So a lot of stations are interested in AMSAT activities, and I have sent them membership applications (F5XU, F5XW, F5SN, FLAOD . . .).

I would thank the stations W3ZM, K1LPL/3, W6AB and their operators, who transmitted news before and during launch of Thor Delta vehicle, on 14.280 and 21.280 MHz.

I congratulate AMSAT headquarters and the people who contributed in successful construction and launch of OSCAR 6.

For the first time, we have a satellite really operating, and 2 meters band is now a DX band with "openings" every 115 minutes, 6 or 7 times a day.

F2DC
Beaumont, France
Feb. 4, 1973

Dear Sirs:

I feel that I must register my thoughts concerning some of the proposals for future satellite programs presented in the December, '72 AMSAT newsletter.

I cannot agree with the concept of a vehicle designed primarily for "DX and Contests," NOR would it be wise to provide "telemetry only" capabilities. Somehow, amateurs occasionally lose sight of the reason we have been provided a sizeable chunk of the RF spectrum; PUBLIC SERVICE!

I agree that the public will be served via a synchronous satellite which provides reliable communications over a wide area, utilizing low powered, inexpensive ground equipment. The public will also be served by the scientific contributions stemming from studies and experiments associated with a satellite in polar orbit containing a comprehensive telemetry system.

I cannot convince myself that the public's best interests will be served by a "DX and Contest" satellite! Conversely, such a program would only further encourage the ILLEGAL use of excessive power, the same bad manners and lack of respect for others' rights as now displayed on the HF bands, coupled with the resultant QRM which would obviate use of the repeater for emergency or public service communications!

I feel that AMSAT has done an excellent job of orbiting a satellite which "has something for everyone" in OSCAR 6. We must not allow individuals or groups representing a narrow range of interests to dictate what programs or experiments should or should not be included; rather, input must be sought from all interested parties, followed by a comprehensive analysis resulting in future satellites which will continue to "have something for everyone," including the public.

In regard to one of the other proposals, the "drifting balloon carrying amateur radio" concept warrants further study. This program would allow not only intriguing communications possibilities, but immense potential for valuable weather studies as well. Certainly, some difficult problems would have to be addressed, such as the possible aeronautical hazards and the random travel habits of such a package.

One further sensitive item that I must address is the financial burden associated with all these programs. I am sure that there are currently many amateurs utilizing OSCAR who are not members of AMSAT, or who have not yet made any contribution to the program. I do not agree with those who would classify these individuals as "free-loaders;" rather I imagine that many have never considered the tremendous amount of time and money involved in the satellite programs to date. To those individuals I extend this plea: if it is within your financial means, please consider either joining AMSAT (dues \$5/year), or making whatever contribution you can manage. It will greatly enhance future efforts.

I apologize for having lapsed into sermonizing; keep up the good work, and my sincere appreciation to all those whose efforts have made OSCAR 6 a reality!

Sincerely,
Ron Dunbar, W0MJS
Burnsville, Mn. 55337
Jan. 6, 1973

Dear Sirs:

I am sending you my first report about the OSCAR 6 activity.

I have tried to work during all the satellite evening orbits, but the QSO's have been poor.

My greatest handicap is the noise that I have on the 29 MHz band from the local car traffic.

I couldn't hear the AMSAT NET-COM on 14 and 21 Mc bands; besides, I don't know when and why the OSCAR 6 is deactivated.

I can tell that during the evening orbits it will be better to work OSCAR 6 after 20:00 Z because the QRM in reception is lower than during the other orbits. This is right for all the QMs who live in the cities where the industrial and automobile QRM is very strong; these problems do not exist for the QM who lives in the countryside.

My working conditions are sufficient for good contacts via OSCAR 6; by my two 144 Mc antennas I can translate on repeater in the most of orbits.

I think that a translator 144/432 Mc is more useful about the noise on the RX. However, I am very glad for OSCAR 6 and I send you my congrats for the wonderful job!!

Best 73,
Michele Senestro
ILTEX
Torino, Italy
Dec. 21, 1972

Dear Sirs:

Re: Letter in Dec. 1972 letters column from Paul Fuge in Oxford, Conn.

I am currently working on a research project in the 24 GHz range. We suffer quite a lot of signal loss due to O₂ resonance in the air so I feel quite certain that any earth based station would find extreme difficulty in getting signals to an orbiting satellite. It would be more likely to work from satellite to satellite or from satellite to moon.

A training issue on spectrum characteristics might be informative to those amateurs who are not involved in the field of radar and remote sensing.

Also, planning comment:

Unless suitable operational precautions can be incorporated in a synchronous repeater/translator, I suggest that future repeater systems remain non-synchronous.

The attractive features of a synchronous satellite (fixed location, wide coverage) are, in my opinion, far outweighed by the disadvantage (continuous access to an enormous number of ground stations) resulting in problems similar to those faced by fixed repeaters in large metropolitan areas.

It is indeed unfortunate that overcrowding cannot be avoided; no matter how courteous the large majority of users there are always a few who abuse the system and degrade its usefulness for everyone.

73,
Larry Eichel, WA2HSP/Ø
Lawrence, Kans.
Feb. 21, 1973

Dear Sirs:

I read with interest your proposal to use atmospheric balloons to carry repeaters. You're probably in a better position in Washington than I to know what the chances of getting FCC approval are for such a project. Possibly good, especially if the frequencies employed are 1215 MHz or more, where there is little chance of causing harmful interference. The definition of spacecraft in the US regulations might cover a balloon that reaches an altitude of 15 miles or so, as it's beyond the major part of the atmosphere.

One thought came to mind as I was reading your piece in the AMSAT newsletter. There's a lot that we don't know about winds in the upper atmosphere, and tracking these balloons, especially if they have gear to telemeter temperature and pressure could make a significant contribution to knowledge of the upper atmosphere.

73,
Rev. Benjamin Clark, WB4OBZ
Mepkin Abbey
Moncks Corner, S. C.
Feb. 2, 1973

Dear Sirs:

I received today your letter with enclosed membership application form and the December issue of the AMSAT newsletter. I was very pleasantly surprised to get this paper, because I am very interested in amateur satellites in all their aspects. Just a week ago I published in the Bulletin of the Central Radioclub of Bulgaria a large article about OSCAR 6 giving all available details on the launching, the mean technical parameters of the repeater, the parameters of the orbit, a table with all data of orbits No. 1001 till 1024, which can be used as base for prediction calculations, and a method for easy calculations to predict the future movement and traffic possibilities of OSCAR 6. At the moment I'm writing another article on OSCAR 6, especially for the German QRV-magazine, which shall be completed with rotating two sheet map, giving the northern hemisphere and the path of OSCAR 6 in polar-azimuthal projection. I think it will be a very clear, simple and practical aid for predictions on OSCAR 6 and all future satellites in sun synchronous orbit. Anyway, the papers you sent to me will give excellent material and data for my future work on this field and thank you sincerely again!

Up today 6 Bulgarian amateur stations have operated via OSCAR 6. These are: LZ1DW, LZ1FO, LZ1BW, LZ1AG, LZ2FA and LZ1AB. About 280 QSOs with 30 countries have been logged.

Sincerely 73,
Wassil Tersiew, LZ1AB
Sofia, Bulgaria
Jan. 24, 1973

WANTED: ALL STATES OPERATING THROUGH OSCAR 6

Our information indicates only 41 of 50 states have amateurs communicating through OSCAR 6. Operation from the following states is badly needed:

Kentucky	Nebraska	New Mexico	Vermont
Louisiana	Nevada	South Dakota	West Virginia
			Wyoming

We urge amateurs in these states to equip for OSCAR 6 operation, or else organize weekend "DXpeditions" to put these states on the air. (Oscar 6 is currently operated Thursdays through Mondays, GMT). Also, Field Day (June 23-24) might be an ideal time to put these states on the air. This is a chance to be the object of a pileup.

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(2)

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14